

APPENDIX H.

Regression Analysis

In Section III and Appendix F, the study team noted that there were statistically significant disparities for some minority groups (and non-Hispanic, white women) in rates of business ownership, earnings of business owners, and frequency of business loan denials. BBC considered the possibility that neutral factors, such as age, education, access to capital and creditworthiness (among others) might account for at least a portion of these disparities. The study team further investigated these issues through multivariate regression analyses. This appendix documents the regression analysis.

In the comparison of availability versus utilization of minority and women-owned firms for the disparity analysis, the study team only considers firms to be available for a potential project if they had previously bid on (or been awarded) a project of similar size. If, however, there are significant disparities in “bid capacity” based on minority or female firm ownership, the study team’s approach might underestimate the availability of minority and women-owned firms in the disparity analysis (and perhaps not find disparities when more comprehensive analysis would reveal them). This appendix also further investigates potential disparities in bid capacity for minority and women-owned firms.

Business Ownership

As discussed in Appendix F, there is an extensive literature on the determinants of business ownership. Prior studies have found that neutral factors such as access to financial capital, education, age, family characteristics (e.g. marital status) and other factors can help explain rates of self-employment.

This issue has also been examined in other disparity studies. Prior studies in Minnesota¹ and Illinois² have conducted econometric analyses to investigate whether or not disparities in business ownership among race, ethnic and gender groups in the combined construction and engineering industry remain after controlling for neutral factors. These studies have incorporated probit econometric models using data from the 2000 Census Public Use Microdata Sample (2000 PUMS). These studies have been among the materials submitted to the courts in subsequent litigation concerning states’ implementation of the Federal DBE Program.

To further examine potential disparities in the rates of business ownership among employees in the Idaho construction and engineering industries, the study team developed a probit model using 2000 PUMS data for Idaho residents employed in these industries. The PUMS data is a 5 percent sample of U.S. households and the Census Bureau assigns a weight to each observation so that the weighted sample is representative of the population as a whole.

¹ National Economic Research Associates, Inc. 2000. *Disadvantaged Business Enterprise Availability Study*. Prepared for the Minnesota Department of Transportation.

² National Economic Research Associates, Inc. 2004. *Disadvantaged Business Enterprise Availability Study*. Prepared for the Illinois Department of Transportation.

The probit model of business ownership in Idaho includes nearly 3,700 individuals working in the construction and engineering industries. The dependent variable is binary—coded as a “1” for individuals who are self-employed and a “0” for individuals who are not self-employed. The model estimates the probabilities of being a business owner among workers in the industry. The study team excluded observations where the Census Bureau had imputed self-employment (the dependent variable).

BBC developed a model specification based on models developed by past researchers at the national level or in other states. Independent variables include:

- Personal characteristics potentially linked to the likelihood of business ownership (age, age-squared, marital status, number of children and elderly people in the household, ability to speak English and disability status);
- Variables to control for differences in educational attainment;
- Measures and indicators related to personal financial resources and constraints (home ownership, home value, monthly mortgage payment, dividend and interest income and additional household income from a spouse or unmarried partner); and
- Variables to indicate the race, ethnicity and gender of the individual.

The specification of this model is very similar to models used in other studies previously reviewed by the courts.

Results for the combined Idaho construction and engineering industries. Figure H-1 presents the coefficients and t-statistics for the initial probit model, which combines individuals working in both the construction and engineering industries. The model indicates that several of the neutral factors are statistically significant in predicting the probability of business ownership;

- Older individuals are more likely to be business owners, but this marginal effect declines for the oldest individuals;
- Individuals with children under 10 in the household are more likely to be business owners;
- Interest and dividend income is positively correlated with being a business owner;
- The likelihood of becoming a business owner is lower among individuals with greater levels of education³; and,
- Individuals with high valued homes are more likely to be business owners.

³ In part, however, this result likely reflects the lower probabilities of business ownership among individuals in the engineering industry—who also tend to have greater education levels. The construction industry in isolation is considered later in this section.

The effects of these neutral factors are generally consistent with previous research on business ownership and entrepreneurship. After controlling for neutral factors identified based on the PUMS data set, statistically significant disparities in rates of business ownership remain for women in the construction and engineering industries, but not for other minority groups.

Figure H-1 presents the results of the probit model of self-employment in the construction and engineering industries in Idaho.

Figure H-1.
Idaho Combined Construction and Engineering Business Ownership Probit Model

Variable	Coefficient	t-statistic
Constant	-3.359643	-7.95 **
Age	0.085547	4.95 **
Age-squared	-0.000760	-3.60 **
Married	0.068212	0.95
Disabled	0.042222	0.45
Own children younger than 10	0.083773	3.40 **
Number of people over 65 in HH	-0.087520	-0.78
Own home	0.033809	0.41
Home value (\$000s)	0.000002	4.75 **
Monthly mortgage payment	-0.000014	-0.18
Interest and dividend income (\$000s)	0.000007	2.59 **
Income of spouse or partner (\$000s)	0.000000	0.31
Speaks English very well	0.205318	0.77
Less than high school education	0.222234	2.45 **
Some college	-0.004608	-0.07
Four year degree	-0.163161	-1.70 *
Advanced degree	-0.461414	-2.85 **
African American	-0.266356	-0.54
Asian Pacific American	-0.603433	-1.42
Hispanic American	-0.297576	-1.61
Native American	-0.202908	-1.03
Other minority group	0.119414	0.28
Female	-0.260080	-3.08 **

Note: *Significant at 90% confidence level.

**Significant at 95% confidence level.

Source BBC Research & Consulting based on analysis of 2000 Census Public Use Microdata Sample.

Results specific to the construction industry. It is possible that the influence of neutral factors, and perhaps race and gender, on self-employment in the construction industry differ from those in the engineering industry. To examine this possibility the study team developed a separate model for the construction industry.

Figure H-2 presents the results of the probit model of self-employment in the Idaho construction industry.

Figure H-2.
Idaho Construction Business Ownership Probit Model

Variable	Coefficient	t-statistic
Constant	-3.437242	-7.78 **
Age	0.085704	4.73 **
Age-squared	-0.000754	-3.41 **
Married	0.068730	0.91
Disabled	0.000853	0.01
Own children younger than 10	0.091288	3.54 **
Number of people over 65 in HH	-0.192805	-1.54
Own home	0.068196	0.80
Home value (\$000s)	0.000001	3.61 **
Monthly mortgage payment	0.000046	0.56
Interest and dividend income (\$000s)	0.000008	2.26 **
Income of spouse or partner (\$000s)	0.000001	0.42
Speaks English very well	0.254340	0.91
Less than high school education	0.216552	2.36 **
Some college	0.043583	0.65
Four year degree	-0.035667	-0.30
Advanced degree	0.002006	0.01
African American	-0.555777	-0.89
Asian Pacific American	-0.115941	-0.23
Hispanic American	-0.279281	-1.49
Native American	-0.226657	-1.13
Other minority group	0.082242	0.19
Female	-0.109535	-1.15

Note: *Significant at 90% confidence level.

**Significant at 95% confidence level.

Source: BBC Research & Consulting based on analysis of 2000 Census Public Use Microdata Sample.

Results of the construction industry only model are generally similar to the model for the combined industries, with the following exceptions:

- While individuals with less than a high school education become business owners more frequently than others in the Idaho construction industry, there are no significant differences in the rate of business ownership among individuals with other levels of educational attainment; and
- After accounting for neutral factors identifiable from the 2000 PUMS data, the model does not indicate statistically significant disparities in business ownership rates for women in the construction industry, or for other minority groups.

Results specific to the engineering industry. Due to the small number of minority business owners in the PUMS data set for the engineering industry, the study team was unable to develop a separate engineering-only business ownership model.

Business Earnings

Appendix F includes analysis of business earnings for business owners in the construction and engineering industries in Idaho. Differences in business owner earnings may be at least partially accounted for by race- and gender-neutral factors such as age.

The study team applied ordinary least squares (OLS) regression analysis to the 2000 PUMS data to examine whether disparities in business earnings remained after controlling for neutral factors. The OLS model of construction and engineering business owner earnings in Idaho included 572 observations. Due to the small number of minority business owners in the sample, the study team evaluated business earnings effects for minority-owned businesses as a whole.

The dependent variable in this model is the natural log of business earnings. Business owners reporting zero or negative business earnings were excluded, as were observations where the Census Bureau had imputed the amount of business earnings. Apart from variables indicating minority status and gender of the business owner, the model also contained the available measures from the PUMS data considered likely to affect earnings potential—including age, age-squared, marital status, ability to speak English very well, disability condition and educational attainment. This model is very similar to models reviewed by the courts after other recent disparity studies.⁴

⁴ For example, National Economic Research Associates, Inc. 2000. *Disadvantaged Business Enterprise Availability Study*. Prepared for the Minnesota Department of Transportation; and National Economic Research Associates, Inc. 2004. *Disadvantaged Business Enterprise Availability Study*. Prepared for the Illinois Department of Transportation.

Results for the Idaho construction and engineering industries. Figure H-3 depicts the results of the OLS model for the combined construction and engineering industries (past studies reviewed by the courts have combined construction and engineering). The model indicates that a few of the neutral factors are statistically significant in predicting earnings of business owners in the Idaho construction and engineering industries:

- Older business owners have greater earnings, but this marginal effect declines for the oldest individuals;
- Disabled business owners have lower earnings;
- Business owners that reported they speak English less than very well had higher earnings, but very few owners were in this group; and
- Business owners with some college, but less than a four year degree, have lower earnings.

After accounting for neutral factors, model results indicate statistically significant disparities in earnings for female business owners. The model also indicates that differences in the earnings of minority business owners were not statistically significant after controlling for other factors.

Figure H-3.
Idaho Combined Construction and Engineering Business Owner Earnings Model

Variable	Coefficient	t-statistic
Constant	5.881037	5.36 **
Age	0.230548	4.45 **
Age-squared	-0.002736	-4.26 **
Married	0.124520	0.79
Speak English Very Well	-0.879894	-1.81 *
Disabled	-1.038162	-2.42 **
Less than HS	0.219112	1.01
Some College	-0.335525	-2.03 **
Four Year Degree	-0.380479	-1.35
Advanced Degree	-0.039119	-0.13
Minority	-0.099981	-0.29
Female	-0.726657	-3.07 **

Note: *Significant at 90% confidence level.
**Significant at 95% confidence level.

Source: BBC Research & Consulting, 2007 based on analysis of 2000 Census Public Use Microdata Sample.

Business owner earnings results specific to the construction industry. The study team recognized that the influences on business owner earnings might differ between construction firms and engineering firms. Figure H-4 presents the results of the OLS model of business owner earnings specific to the Idaho construction industry.

Figure H-4.
Idaho Construction Business Owner Earnings Model

Variable	Coefficient	t-statistic
Constant	5.941389	5.14 **
Age	0.228401	4.22 **
Age-squared	-0.002713	-4.05 **
Married	0.180664	1.10
Speak English Very Well	-0.912134	-1.76 *
Disabled	-1.064836	-2.43 **
Less than HS	0.230929	1.06
Some College	-0.314886	-1.85 *
Four Year Degree	-0.151818	-0.47
Advanced Degree	0.027152	0.11
Minority	-0.232777	-0.62
Female	-0.704168	-2.61 **

Note: *Significant at 90% confidence level.
**Significant at 95% confidence level.

Source: BBC Research & Consulting, 2007 based on analysis of 2000 Census Public Use Microdata Sample.

The construction-only model of business owner earnings shows very similar influences from neutral factors as observed in the previous model combining construction and engineering firms. After controlling for neutral influences, model results continue to indicate that business earnings for female business owners in the construction industry are significantly lower than for similarly situated, non-Hispanic, white business owners.

BBC simulated business earnings for women in the construction industry in the absence of race and gender-related effects. Figure H-5 depicts simulated business earnings for women in the construction industry and compares them to the actual, observed mean probability of business earnings for female construction business owners. Results suggest that female business owners in the construction industry earn about 51 percent less than they would if they earned as much as similarly situated non-Hispanic, white males.

Figure H-5.
Comparison of Actual Construction Business Owner Earnings to Simulated Earnings Under Non-Hispanic, White Male Business Environment for Groups Experiencing Significant Disparities

Group	Self-employment Rates		Disparity index (100 = parity)
	Actual	Benchmark	
Female	\$ 6,919	\$ 14,049	49

Source: BBC Research & Consulting from statistical models of 2000 Census of Population data.

Results specific to the engineering industry. Again, due to the small number of minority business owners in the PUMS data set, the study team was unable to develop a separate engineering-only business owner earnings model.

Likelihood of Business Loan Denial

As discussed in Appendix F, access to capital is an important factor in small business formation and expansion. Based on data for both the nation and the Mountain region from the 1998 National Survey of Small Business Finances (NSSBF), minority-owned firms are more frequently denied on business loan applications than non-Hispanic, white-owned firms.

Previous studies have used probit econometric analysis in an effort to determine whether higher rates of loan denial for minorities can be explained by neutral factors. The standard model includes four types of variables that describe:

- The owner's credit and resources;
- The firm's credit and financial health;
- The environment in which the firm and lender operate, and
- Whether or not the owner is a member of a minority group.⁵

To examine whether neutral factors might explain the higher rates of loan denials for minority groups, the study team developed a probit model using the data from the 1998 NSSBF. After excluding a small number of observations where the loan outcome was imputed, the national sample included 932 firms that had applied for a loan during the three years preceding the survey. The Mountain region included 77 such firms.

A large number of variables are required to control for differences in the neutral factors described previously. A total of 58 variables are included to represent the owners credit and resources (10 variables), the firm's credit and financial health (29 variables) and the environment in which the firm and lender operate including the nature of the loan applied for (19 variables). Given the relatively small sample sizes and the large number of variables the model requires, the study team did not attempt to estimate this model for the Mountain region by itself. Instead, we estimate a model that includes observations throughout the country and seek to identify any significant differences between the national credit market and the Mountain region credit market through interaction terms. These interactions include firms located in the Mountain region and firms owned by minorities and women in the region. This approach has been used in previous, peer-reviewed research.⁶

Figure H-6 on the following page presents the coefficients and t-statistics from the probit model of loan denials.

⁵ See, for example, Blanchard, Lloyd; Zao, Bo and John Yinger. 2005. *Do Credit Barriers Exist for Minority and Women Entrepreneurs?* Center for Policy Research, Syracuse University.

⁶ Blanchflower, David G.; Levine, Phillip B. and David J. Zimmerman. 2003. "Discrimination in the Small-Business Credit Market." *The Review of Economics and Statistics*. 85(4): 930-943.

Figure H-6.
Dependent Variable: Loan Denial

Variable	Coefficient	t-statistic	Variable	Coefficient	t-statistic	Variable	Coefficient	t-statistic
Race/ethnicity/gender			Firm's Credit and Financial Health			Firm and Lender Environment and Loan Characteristics		
Constant	-5.757145	-4.47 **	D&B credit score = moderate risk	0.761127	1.50	Partnership	0.047895	0.14
Minority	0.885652	5.49 **	D&B credit score = average risk	0.796850	1.57	S corporation	-0.282553	-1.22
Female	0.045572	0.27	D&B credit score = significant risk	0.576757	1.11	C corporation	-0.298445	-1.07
Mountain Region	0.268190	0.82	D&B credit score = high risk	0.488350	0.87	Construction industry	0.529184	1.99 **
Minority in Mountain Region	-0.004220	-0.01	Total employees	-0.001399	-0.48	Manufacturing industry	0.269285	1.03
Female in Mountain Region	-0.628784	-0.90	Percent of business owned by principal	-0.002529	-0.56	Transportation, communications and utilities industry	0.290553	0.67
Owners Credit and Resources			Family owned business	0.669331	2.32 **	Finance, insurance and real estate industries	-0.064389	-0.18
Age	0.006314	0.80	Firm purchased	-0.322277	-1.68 *	Engineering industry	0.616558	1.71 *
Owner Experience	0.013064	1.21	Firm inherited	-1.046112	-0.28	Other industry	0.246481	1.28
Less than high school education	0.175602	0.55	Firm age	-0.015050	-1.40	Herfindahl index = .10 to .18	2.478028	4.40 **
Some college	-0.151659	-0.75	Firm has checking account	0.344229	1.03	Herfindahl index = .18 or above	0.563648	4.98 **
Four year degree	-0.529348	-2.45 *	Firm has savings account	-0.161990	-0.93	Located in MSA	0.217083	1.21
Advanced degree	-0.476703	-1.98 **	Firm has line of credit	-0.896570	-4.90 **	Sales market local only	0.157603	1.01
Bankruptcy in past 7 years	1.532468	2.86 **	Existing capital leases	-0.080220	-0.42	Loan amount	0.000000	0.15
Judgement against in past 3 years	1.128853	3.70 **	Existing mortgage for business	-0.351520	-1.73 *	Capital lease application	-0.101897	-0.30
Log of net worth excluding home	-0.028694	-0.51	Existing vehicle loans	-0.546695	-2.98 **	Business mortgage application	-0.799572	-2.91 **
Owner has negative net worth (indicator)	-0.529616	-0.77	Existing equipment loans	-0.546290	-2.55 **	Vehicle loan application	-1.121778	-3.90 **
			Existing loans from stockholders	0.524311	2.60 **	Equipment loan application	-0.741263	-2.66 **
			Other existing loans	-0.133730	-0.70	Loan for other purposes	-0.286563	-1.44
			Firm used trade credit in past year	-0.217514	-1.38			
			Log of total sales in prior year	0.001814	0.03			
			Negative sales in prior year (indicator)	0.327558	0.40			
			Log of cost of doing business in prior year	0.005052	0.10			
			Log of total assets	0.020252	0.29			
			Negative total assets (indicator)	-0.203130	-0.23			
			Log of total equity	0.081684	1.10			
			Negative total equity (indicator)	0.812546	1.06			
			Firm bankruptcy in past 7 years	0.801655	1.66 *			
			Firm delinquency in business transactions	1.216614	6.74 **			

Note: * Significant at 90% confidence level.

** Significant at 95% confidence level.

Source: BBC Research & Consulting analysis of 1998 NSSBF data.

The loan denial model indicates that a number of neutral factors are significantly correlated with the probability of loan denial. These include:

- **Factors specific to the business owner, including education and whether or not the owner had been personally bankrupt or had a judgment against them within the past seven years.** Business owners with a four-year college degree or an advanced degree are less likely to be denied.
- **Factors related to the firm's credit and financial health, including if the firm had existing loans and lines of credit.** Family-owned firms are more likely to be denied while firms that were purchased are less likely. Firms with delinquencies in business transactions are also more likely to be denied.
- **Some of the firm, lender and loan environment characteristics.** Firms in the construction and engineering industries are more likely to have their loan applications denied than other firms. Firms in highly concentrated industry segments (as measured by the Herfindahl Index) are also more likely to be denied. Potentially collateralized loans such as business mortgages, vehicle loans and equipment loans are less likely to be denied.

After accounting for these and the other potential neutral influences, minority-owned firms remain significantly more likely to have their loans denied than other firms. The interaction terms for the Mountain region, and for minority- and women-owned firms within the region, are insignificant. This result implies that the probabilities of loan denials for minority- and women-owned firms within the Mountain region are not statistically different from the national probabilities.

The study team simulated loan approval rates for minority-owned firms (note that the approval rate is equal to one minus the denial rate) in the absence of race, ethnicity and gender effects. Figure H-7 shows the simulated loan approval rate and compares it to the actual, observed mean probability of loan approval for minorities in the NSSBF data set.

Exhibit H-7.

Comparison of Actual Loan Approval Rates to Simulated Loan Approval Rates Under Non-Hispanic, White Male Business Environment for Groups Experiencing Significant Disparities

Group	Loan Approval Rates		Disparity Index (100 = parity)
	Actual	Benchmark	
Minority	57.2%	82.2%	70

Source: BBC Research & Consulting analysis of 1998 NSSBF data.

Based on the NSSBF data, minority-owned firms that applied for loans were denied at a rate of nearly 43 percent. Model results show that minority-owned firms would be denied loans about 18 percent of the time if they were denied at the same rate as similarly situated firms owned by non-Hispanic, white males.

Bid Capacity

One of the requirements for a firm to be considered available for an ITD project in BBC's disparity analysis is that the firm had previously bid on, or been awarded, another contract or subcontract of similar size. The study team considers the largest previous bid (or award) by a firm to be the measure of its "bid capacity." The following analysis considers whether there is evidence of disparities in bid capacity for minority- and women-owned firms in the Idaho construction and engineering industries.

The study team conducted an extensive survey of Idaho, Eastern Washington and Northern Utah transportation construction and engineering firms, which is described in Appendix C of the report. The team attempted to contact every establishment located in this region in the relevant lines of business. After narrowing the sample to firms in pertinent lines of work with appropriate experience and interest for ITD projects, and compressing multiple responses from multi-establishment firms in the region into single firm observations, the survey effort produced a database of 1,351 firms potentially available for ITD work.⁷ Of these firms, 519 provided valid information on their largest previous bid and/or contract and met other criteria required to be considered available for transportation-related work in Idaho.⁸ The following analysis of bid capacity relies on the results of the Availability Survey.

One of the factors that affects bid capacity is the industry specialization of construction and engineering firms. Some industry segments, such as construction of water, sewer and utility lines, apparently involve larger projects. Other segments, such as electrical work, involve smaller scale assignments. One way of controlling for variation in bid capacities in different sub-industries is to assess whether or not a firm has a bid capacity above or below the median level for firms in that sub-industry. BBC can then test whether minority- and women-owned firms bid on larger or smaller contracts or subcontracts compared with other firms in their sub-industry.

⁷ See Appendix C, pages 5 through 7 for further description of the survey sample and process.

⁸ Other availability criteria included appropriate geographic scope for the business and self-reported qualifications and interest in future transportation work in Idaho.

Figure H-8 indicates the median bid capacity among Idaho-based establishments in each of the 22 industry segments within the construction and engineering industries. Note that the survey questions regarding the largest project that firms had bid on or been awarded captured data in dollar ranges rather than specific dollar amounts.

Figure H-8.
Median Bid Capacity by Industry Segment

Industry Segment	Median Bid Capacity
Consulting and Research	\$100,000 or less
Engineering and Design Services	Over \$100,000 to \$500,000
Surveying and Mapping Services	\$100,000 or less
Traffic Control	\$500,000
Testing and Remediation	Over \$100,000 to \$500,000
Landscape Counseling and Planning	Over \$100,000 to \$500,000
Fence and Landscape Installation	\$100,000 or less
Earthwork, Drilling, and Other Site Prep	Over \$100,000 to \$500,000
Masonry Foundations and Walls	Over \$500,000 to \$1 million
Structural Steel Erection	\$500,000
Wrecking and Demolition	Over \$100,000 to \$500,000
Sweeping Service	\$100,000 or less
Electrical Work	Over \$100,000 to \$500,000
Water, Sewer, and Utility Lines Work	Over \$100,000 to \$500,000
Highway, Bridge, Concrete, and Tunnel Construction	Over \$500,000 to \$1 million
Pavement Marking	Over \$500,000 to \$1 million
Traffic Signs/Signals and Other Electrical Equipme	\$100,000
Metal Products Supply	Over \$100,000 to \$500,000
Surface Paving Materials (Ready-Mix and Asphalt Mi	Over \$500,000 to \$1 million
Aggregate, Rock and Sand	\$500,000
Equipment Supply and Rental	Over \$100,000 to \$500,000
Trucking	\$100,000 or less

Source: BBC Research & Consulting, 2007 Availability Survey.

Firms with bid capacities above the median (“above average”) for their industry segments are counted as available for larger ITD projects than most of the firms in their line of business (as well counted as available for smaller assignments). Thus, these firms figure more prominently in the availability analysis than firms with smaller bid capacities. An initial question is whether or not minority and women-owned firms are as likely as majority owned firms to have above average bid capacity for their industry segment. Figure H-9 compares the proportions of firms with above average bid capacity by ownership. Due to the relatively small number of minority owned businesses in the sample, the study team evaluated bid capacity effects for minority-owned businesses as a whole.

**Figure H-9.
Proportion of Firms
with Above Average Bid
Capacity by Ownership**

Source:
BBC Research & Consulting, 2007
Availability Survey.

Firm Ownership	Proportion With Above-Median Bid Capacity	
	Construction	Engineering
Minority	25.0%	25.0%
Female	50.0%	22.9%
Majority-owned	37.1%	36.0%
All Firms	38.5%	33.6%

The results shown in Figure H-9 indicate that the proportion of minority and women-owned businesses with above average bid capacity differs from the proportion of firms owned by non-Hispanic, white males with above average bid capacity. Minority-owned construction firms appear less likely to have above average bid capacity. Construction firms owned by women more frequently have above average bid capacity than majority-owned firms.

Figure H-9 also indicates that minority and women-owned engineering firms are generally less likely to have above average bid capacity.

BBC considered whether neutral factors account for differences among groups in the probability of having above average bid capacity and if there are statistically significant disparities in bid capacity after accounting for neutral factors.

There are a number of variables from the Availability Survey that may be correlated with bid capacity. Annual revenues, number of employees and, potentially, whether or not a firm has multiple establishments in Idaho, are examples. However, the direction of causation for these variables is unclear. Do firms have greater bid capacity because they have more employees, or do they have more employees because they bid on and win larger assignments?

After considering the array of variables from the Availability Survey, the study team determined that the neutral factor (beyond subindustry) that might best explain differences in bid capacity while being truly exogenous to that capacity was age of the firm. Theoretically, the longer firms are in business, the larger the contract or subcontract they may pursue.

To test this hypothesis, the study team conducted separate logistic regression analyses for the construction and engineering industries to determine whether or not bid capacity could be at least partly explained by the age of the firm and whether or not minority- and women-owned firms differ from majority-owned firms of similar ages.

Bid capacity results for the Idaho construction industry. Results for the Idaho construction industry are shown in Figure H-10, below. The logistic regression model indicates:

- The age of the firm is a significant predictor of having above average bid capacity;
- Women-owned construction firms in Idaho are significantly more likely to have above average bid capacity, even after controlling for firm age; and
- Remaining differences in the likelihood of having above average bid capacity for minority - owned firms (after controlling for firm age) were not statistically significant.

Figure H-10.
Idaho Construction Industry Bid Capacity Model

Variable	Coefficient	Wald-statistic
Constant	-0.989	19.692 **
Age of firm	0.019	7.853 **
Minority	-0.572	1.328
Female	0.639	3.410 *

Note: *Significant at 90% confidence level.

**Significant at 95% confidence level.

Source: BBC Research & Consulting, 2007 Availability Survey.

Bid capacity results for the Idaho engineering industry. Results for the Idaho engineering industry are shown in Figure H-11, below. The logistic regression model for this industry indicates:

- The age of the firm is a significant predictor of having above average bid capacity for engineering as well as construction; and

Any remaining negative differences in the likelihood of having above average bid capacity for minority and women-owned firms were not statistically significant.

Figure H-11
Idaho Engineering Industry Bid Capacity Model

Variable	Coefficient	Wald-statistic
Constant	-0.997	16.136 **
Age of firm	0.015	4.526 **
Minority	-0.424	0.372
Female	-0.465	1.121

Note: *Significant at 90% confidence level.

**Significant at 95% confidence level.

Source: BBC Research & Consulting, 2007 Availability Survey.